Title of the grant:

Solar Wind Fluctuations & Their Consequences on the Magnetosphere

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Principal Investigator: Xinlin Li

Name and address of the grantee's institution:

The Regents of the University of Colorado
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Efforts have been made to extract the physical meaning of each term in our prediction model of the Dst index using the solar wind as the only input. The work has been published Journal of Geophysical Research [Temerin and Li, 2002]. We found different terms in the model representing different current in the magnetospheric system and each current has different rise and decay times, with the symmetric ring current the slowest, then the partial ring current, then the tail current.

We also have been trying to understand the physical meaning of the diffusion coefficient used in our prediction model of relativistic electron fluxes at geostationary orbit. The model reproduced the observations of MeV electron flux variations well, the diffusion coefficient had be assumed only due to local magnetic field fluctuations, leading to its 10th power dependence on the L. We have studied the theoretical derivation of the diffusion coefficient and we believe that the effect electric field fluctuations at smaller L should become more significant.

We have expanded our previous radiation belt electron prediction model, which predicted MeV electron at geosynchronous orbit based on solar wind measurements, to predict MeV electrons inside geosynchronous orbit. The model results are compared with measurements from Polar/CEPPAD. Prediction efficiencies of 0.56 and 0.54, respectively, at L=6 and L=4, have been achieved over the entire year of 1998. This work was reported at 2003 Fall AGU and has been accepted for publication in Space Weather [Barker et al., 2005]

We also have used simultaneous measurements of the upstream solar wind and of energetic electrons at geosynchronous orbit to analyze the response of electrons over a very wide energy range, 50 keV - 6 MeV, to solar wind variations. Enhancements of energetic electron fluxes over this whole energy range are modulated by the solar wind speed and the polarity of the interplanetary magnetic field (IMF). The solar wind speed seems to be a dominant controlling parameter for electrons of all energy. This work has been published in Space Weather [Li et al., 2005].

[Temerin and Li, 2002]Temerin, M., and X. Li, A New Model for the Prediction of SDstS on the Basis of the Solar Wind, Journal of Geophysical Research, Vol. 107, No. A12, 1472, 2002.

[Barker et al., 2005]Barker, A. B., X. Li, and R. S. Selesnick, Case Study of Radiation Belt Electrons During Magnetic Storms Based on Solar Wind Measurements, Space Weather, in press, 2005.

Li, X., D. N. Baker, M. Temerin, G. D. Reeves, R. Friedel, and C. Shen, Energetic electrons, 50 keV -- 6 MeV, at geosynchronous orbit: their responses to solar wind variations, Space Weather, 3, S04001, doi:10.1029/2004SW000105, 2005.